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Date: May 4, 2018

Client: Howarth Group

Property: Morrison Strip Center
738 Parkway,
Gatlinburg, TN 37738

Dear Mr. Howarth:

This letter will serve as an interpretation with recommendations from our particulate matter sampling at the above referenced property. Air sampling and tape lift sampling was performed by Forensic Building Science (FBS) on April 4, 2018 in response to a recent forest fire.

I. Summary of Opinions

Based on the site inspection and documentation of the damages conducted by FBS, including review of the results of our soot sampling I have concluded that the property in question located at 738 Pkwy, Gatlinburg, TN 37738 has been damaged by the wild fire through the deposition of soot and ash throughout the roof assemblies, window assemblies, interior partition walls, light fixtures and ducting. Based on the sample results, and the type of construction in the building, it is my opinion that the forest fire caused damage to the building through the deposition of carcinogenic soot into hidden wall, ceiling and floor cavities. This soot is still viable in the ambient air as evidenced by our sampling results.

II. Sampling Results

N.G. Carlson Analytical, Inc.
216 16th Ave. S.W.
New Brighton, MN 55112

April 22, 2018

RE: Morrison 738 Pkwy, Gatlinburg, TN 37738

Air-o-cell cassette samples (April 4, 2018)

Location (description from chain of custody)	Trace density	Primary Particles	Notes
1 – Dining Room Exterior wall (30 liters)	Light Trace	Char [<0.5] Soot [<0.5]	
2 – Dining Room Interior wall (30 liters)	Light Trace	No Char No Soot	
3 – Dining Room dropped ceiling cavity (30 liters)	Moderate Trace	Char [<1] No Soot	
4 – Dining Room exterior wall (30 liters)	Moderate Trace	No Char No Soot	
5 – Dining Room exterior wall (30 liters)	Light Trace	Char [<0.5] No Soot	
8 – Bedroom hallway interior wall (30 liters)	Light Trace	No Char No Soot	
9 – Women's bathroom ceiling cavity (30 liters)	Heavy trace	Char [<1] Soot [<1]	
11 – Outside back elevation exterior wall (30 liters)	Heavy trace	Char [<1] Soot [<0.5]	

12 – Outside right elevation exterior wall (30 liters)	Heavy trace	Char [3-4] Soot [<0.5]	
13 – Vape shop back of store exterior wall (30 liters)	Moderate trace	Char [<0.5] No Soot	
16 – Gift shop above dropped ceiling ambient air (75 liters)	Moderate trace	Char [<1] Soot [<0.5]	
18 – Gift shop back storage room above dropped ceiling interior wall (30 liters)	Light trace	Char [<0.5] Soot [<0.5]	
20 – Old Time photos main room above dropped ceiling interior wall (30 liters)	Light trace	Char [<0.5] No Soot	

Tease tape samples (April 4, 2018)

Location (description from chain of custody)	Trace density notes	Primary Particles	Notes
6 – Dining Room trim top of wall tape lift		Char [1-2] No Soot	<i>Cladosporium</i> spp. growth

7 – Dining Room ceiling next to ventilation tape lift		Char [2-3] Soot [<0.5]	
10 – Restroom Hallway dropped ceiling tape lift		Char [10-15] Soot [<1]	Some elevated fungal spore deposition
14 – Vape shop ceiling vent tape lift		Char [10-15] Soot [<0.5]	
15 – Vape shop back of dropped ceiling tile tape lift		Char [2-4] Soot [1-2]	
17 – Gift shop back storage room above dropped ceiling metal pipe tape lift		Char [3-5] Soot [<1] Carbon black [3-4]	
19 – Mayfield back of store above dropped ceiling sprinkler metal pipe tape lift		Char [2-3] Soot [<1]	<i>Chaetomium</i> spp. elevated spore levels
21 – Old time photo Entrance/foyer ceiling vent tape lift		Char [20-30] No soot	<i>Cladosporium</i> spp. growth
22 – Old time photo main room above dropped ceiling metal pipe tape lift		Char [3-4] Carbon black [1-2] No soot	

Char and soot-like particle interpretation:

Less than 0.5 particles per field (400x) - negligible impact of smoke
0.5 and 2.0 particles per field (400x) - limited impact of smoke
2.0 and 10 particles per field (400x) - moderate impact of smoke
10 - 50 particles per field (400x) - Significant impact of smoke
> 50 particles per field TNTC - Major impact of smoke
* Several large clusters of soot-like particles noted

Methods:

The tease tape and Air-o-cell Cassette traces were identified under light microscopy viewed at 100x, 200x and 400x. Lacto fuchsin stain in 85% lactic acid was used to aid in identification.

No chemical identification was conducted on the soot-like, char-like particles, and carbon black-like particles. Presumptive identification was based on particle morphology.

Discussion:

Soot levels varied from not noted to negligible on the tease tape samples.
Char levels varied from not noted to significant on the tease tape samples.

Char levels varied from not noted to moderate on the air samples.
Soot levels varied from not noted to limited on the air samples.

Sincerely,



Neil G. Carlson, C.I.H.
N.G. Carlson Analytical, INC.

III. Sampling Discussion

Typically, in post fire remediation strategies recommended by fire restoration companies and insurance companies, walls, ceilings and floors that do not show signs of actual fire damage [e.g. char, physically burned materials] are left in place and either surfaced cleaned or repainted. Post remediation complaints from building occupants often include descriptions of a “lingering smoke smell” months and years later, particularly when large variations in temperature and humidity occur. Soot left in these cavities is “recharged” by this increase in water vapor drive from the humidity causing the smell to present.

FBS collected a total of 22 interior samples at the Morrison Strip Center building. The primary purpose of the sample collection was to determine whether or not smoke soot consistent with the reported fire event is in the ceiling, wall, floor and ducting cavities, wire chase ways and other open bypass areas and assist in developing recommendations for repairs.

All the air samples were collected with an air sampling pump calibrated to run at a volume of 15 liters per minute. The sample duration varied by location. The air samples were collected with Air-O-Cell sampling cassettes.

The ambient air samples were collected for a five-minute sample period to use for comparison purposes. Tape lifts and were collected from visible surfaces where no sign of soot was viewed.

The sample locations were chosen based on my training, education and experience and the site-specific inspections and similar projects with similar failure mechanisms. All the samples were collected and entered in to a sample chain of custody. After the sampling was completed, the samples were delivered to Neil Carlson, CIH, of NG Carlson Analytical. The analysis of the results is included in the report from him.

In addition to the sample chain of custody, the locations of all the samples were written down in a site log book so that the information can be more easily viewed.

IV. Description of Soot

Definition of Soot:

Soot is a general term that refers to the black, impure carbon particles resulting from the incomplete combustion of a hydrocarbon. It is more properly restricted to the product of the gas-phase combustion process but is commonly extended to include the residual pyrolyzed fuel particles such as [cenospheres](#), charred wood, petroleum coke, etc. that may become airborne during pyrolysis and which are more properly identified as cokes or chars. The gas-phase soots contain polycyclic aromatic hydrocarbons (PAHs). The PAHs in soot are known mutagens and probable human carcinogens. Soot is in the general category of airborne [particulate matter](#), and as such is considered hazardous to the lungs and general health. Soot is classified as a "Known Human Carcinogen" by the International Agency for Research on Cancer (IARC).ⁱ

V. Conclusions

Soot and/or Char was found in concentrations of 1.0 particles per field or greater in 10 of the 22 locations sampled [45% of the samples taken]. All tease tape samples that were taken showed high concentrations of soot and/or char. Generally, exterior walls were affected, while interior partition walls were lightly affected. All of the buildings HVAC ducting, electrical outlets, plumping chases, dropped soffits, dropped ceiling components and common room areas were typically affected. This should include ceiling light fixtures.

Based on the results of the sampling, all insulation should be removed from interior walls, and all dropped ceilings, electrical chases, ducting, and top surfaces of exposed framing should be cleaned by HEPA and back sprayed with BIN primer.

All ceiling lights and electrical outlets should be detached, cleaned and reset. To eliminate cross contamination removal should be done using enclosed critical containments and HEPA filtration units.

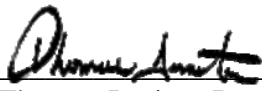
Forensic Building Science's opinions and recommendations are made without regard to coverage. The Insurance Carrier determines coverage and any issues related to coverage are the responsibility of the Insured and the Carrier. Discovery is ongoing. Additional testing and inspections may need to be performed and additional and/or supplemental information and opinions may be contained in future reports issued by Forensic Building Science, Inc. This report is the exclusive property of the client noted previously and cannot be relied upon by a third party. Copies of this report are released to third parties only by written permission of the client.



Adam Piero, Field Investigator

May 3, 2018

Date



Thomas Irmiter, President & Owner

May 3, 2018

Date

ⁱ Reference

US Department of Health and Human Services. Public Health Service, National Toxicology Program. Report on Carcinogens, Twelfth Edition. 2011. Accessed at <http://ntp.niehs.nih.gov/ntp/roc/twelfth/roc12.pdf> on June 14, 2011.